

A m e n d e d   c l a i m s .

1. A well injection string (4) for injection of a fluid into  
at least one reservoir (6) intersected by the string (4),  
in which at least a part of the injection string (4) in-  
cludes at least one fluid outflow zone provided with one  
or more through-going pipe wall openings (28, 87) located  
opposite the reservoir (6) when placed therein, and in  
which at least one pressure-loss-promoting flow control  
device in the form of a flow restriction is provided to  
at least one of said pipe wall openings (28, 87) in the  
injection string (4), the flow control device controlling  
the injection fluid outflow rate therethrough and onwards  
into the reservoir (6) when placed therein, c h a r -  
a c t e r i z e d   i n   t h a t   s a i d   f l o w   r e s t r i c t i o n   i s   s e -  
l e c t e d   f r o m   t h e   f o l l o w i n g   t y p e s   o f   f l o w   r e s t r i c t i o n s :
  - a nozzle;
  - an orifice in the form of a slot or a hole; and
  - a sealing plug.
2. The well injection string (4) according to claim 1,  
c h a r a c t e r i z e d   i n   t h a t   s a i d   f l o w   r e s t r i c t i o n  
is provided as a removable and replaceable insert (12).
3. The well injection string (4) according to claim 2,  
c h a r a c t e r i z e d   i n   t h a t   t h e   i n s e r t   ( 1 2 )   i s  
disposed in an insert bore (28) in the pipe wall of the  
string (4), the bore (28) comprising said pipe wall open-  
ing in the injection string (4), whereby said outflow  
zone may be provided with several insert bores (28), each  
bore (28) containing a removable insert (12).

4. The well injection string (4) according to claim 2,  
c h a r a c t e r i z e d i n t h a t t h e i n s e r t (12) i s  
disposed in an axially through-going insert bore (32, 92)  
in an annular collar (34, 90) disposed pressure-sealingly  
around the injection string (4) so as to project out-  
wardly therefrom; and wherein the collar (34, 90) also is  
disposed pressure-sealingly against an external and re-  
movable housing (36, 42, 86) pressure-sealingly enclosing  
said at least one pipe wall opening (28, 87) in the in-  
jection string (4), thereby providing a through-going  
flow channel (38, 88) between the collar (34) and the at  
least one pipe wall opening (28, 87), whereby the collar  
(34, 90) may be provided with several insert bores (32,  
92) around the circumference thereof, each bore (32, 92)  
containing a removable insert (12).
5. The well injection string (4) according to claim 2, 3 or  
4, c h a r a c t e r i z e d i n t h a t a n o u t f l o w z o n e  
having two or more inserts (12) arranged thereto, is pro-  
vided with a mixture of said types of flow restrictions.
6. The well injection string (4) according to any of claims  
2-5, c h a r a c t e r i z e d i n t h a t a n o u t f l o w z o n e  
arranged with two or more inserts (12) containing a noz-  
zle or an orifice each, is provided with nozzles or ori-  
fices of similar or dissimilar internal opening sizes.
7. The well injection string (4) according to any of claims  
2-6, c h a r a c t e r i z e d i n t h a t t h e i n s e r t s  
(12) in the string (4) are of identical external size and  
shape.

8. The well injection string (4) according to any of claims 4-7, characterized in that the downstream side of said housing (36, 42, 86) is extended axially and past said collar (34, 90), said extension of the housing (36, 42, 86) thereby forming a through-going and annular fluid collision chamber (48, 100) within which the injection fluid is subjected to a pressure-reducing energy loss.
9. The well injection string (4) according to claim 8, characterized in that a flow-through grid plate or perforated plate (50) of erosion-resistant material is disposed in said fluid collision chamber (48, 100).
10. The well injection string (4) according to any of claims 4-9, characterized in that the downstream side of the housing (36, 42, 54, 86) is connected to a sand screen (44, 98).
11. A method of controlling an injection fluid outflow rate from at least one fluid outflow zone of a well injection string (4) intersecting at least one reservoir (6), the at least one fluid outflow zone being provided with one or more through-going pipe wall openings (28, 87) located opposite the reservoir (6) when placed therein, said method being initiated by injecting said fluid from surface via the injection string (4) and then through at least one pressure-loss-promoting flow control device in the form of a flow restriction provided to at least one of said pipe wall openings (28, 87) in the injection string (4), after which the injection fluid flows onwards

into the surrounding reservoir (6), c h a r a c t e r -  
i z e d i n that the method further comprises selecting  
said flow restriction from the following types of flow  
restrictions:

- a nozzle;
- an orifice in the form of a slot or a hole; and
- a sealing plug.

12. The method according to claim 11, c h a r a c t e r -  
i z e d i n that the method further comprises:  
- forming said flow restriction as a removable and re-  
placeable insert (12).

13. The method according to claim 12, c h a r a c t e r -  
i z e d i n that the method further comprises:  
- disposing the insert (12) in an insert bore (28) in the  
pipe wall of the string (4), the bore (28) comprising  
said pipe wall opening in the injection string (4),  
whereby said outflow zone may be provided with several  
insert bores (28), each bore (28) containing a removable  
insert (12).

14. The method according to claim 12, c h a r a c t e r -  
i z e d i n that the method further comprises:  
- disposing the insert (12) in an axially through-going  
insert bore (32, 92) in an annular collar (34, 90) dis-  
posed pressure-sealingly around the injection string (4)  
so as to project outwardly therefrom, the collar (34, 90)  
also being disposed pressure-sealingly against an exter-  
nal and removable housing (36, 42, 86) pressure-sealingly  
enclosing said at least one pipe wall opening (28, 87) in  
the injection string (4), thereby providing a through-

going flow channel (38, 88) between the collar (34) and  
 the at least one pipe wall opening (28, 87), whereby the  
 collar (34, 90) may be provided with several insert bores  
 (32, 92) around the circumference thereof, and a remov-  
 5 able insert (12) being disposed in each bore (32, 92).

15. The method according to claim 12, 13 or 14, c h a r -  
 a c t e r i z e d i n that the method further comprises:  
 - providing an outflow zone having two or more inserts  
 (12) arranged thereto, with a mixture of said types of  
 10 flow restrictions.

16. The method according to any of claims 12-15, c h a r -  
 a c t e r i z e d i n that the method further comprises:  
 - providing an outflow zone having two or more inserts  
 (12) arranged thereto, with nozzles or orifices of simi-  
 15 lar or dissimilar internal opening sizes.

17. The method according to any of claims 12-16, c h a r -  
 a c t e r i z e d i n that the method further comprises:  
 - providing the string (4) with inserts (12) of identical  
 external size and shape.

20 18. The method according to any of claims 14-17, c h a r -  
 a c t e r i z e d i n that the method further comprises:  
 - extending the downstream side of said housing (36, 42,  
 86) axially and past said collar (34, 90), the extension  
 of the housing (36, 42, 86) thereby forming a through-  
 25 going and annular fluid collision chamber (48, 100)  
 within which the injection fluid is subjected to a pres-  
 sure-reducing energy loss.

19. The method according to claim 18, c h a r a c t e r -  
i z e d i n that the method further comprises:  
- disposing a flow-through grid plate or perforated plate  
(50) of erosion-resistant material in said fluid colli-  
sion chamber (48, 100).

20. The method according to any of claims 14-19, c h a r -  
a c t e r i z e d i n that the method further comprises:  
- connecting the downstream side of the housing (36, 42,  
54, 86) to a sand screen (44, 98).

21. A well injection string (4) for injection of a fluid into  
at least one reservoir (6) intersected by the string (4),  
in which at least a part of the injection string (4) in-  
cludes at least one fluid outflow zone provided with one  
or more through-going pipe wall openings (28) located op-  
posite the reservoir (6) when placed therein, and in  
which at least one pressure-loss-promoting flow control  
device is provided to at least one of said pipe wall  
openings (28) in the injection string (4), the flow con-  
trol device controlling the injection fluid outflow rate  
therethrough and onwards into the reservoir (6) when  
placed therein, c h a r a c t e r i z e d i n that the  
flow control device comprises an annular collar (56) pro-  
vided with at least one axially through-going bore (58);  
wherein the collar (56) is disposed pressure-sealingly  
around the injection string (4) so as to project out-  
wardly therefrom; and wherein the collar (56) also is  
disposed pressure-sealingly against an external and re-  
movable housing (54) pressure-sealingly enclosing said at  
least one pipe wall opening (28) in the injection string  
(4), thereby providing a through-going flow channel (38)

between the collar (56) and the at least one pipe wall opening (28).

22. The well injection string (4) according to claim 21,  
c h a r a c t e r i z e d i n that two or more collars  
5 (56) are connected in series when placing two or more  
flow control devices within one fluid outflow zone along  
the injection string (4).

23. The well injection string (4) according to claim 21 or  
22, c h a r a c t e r i z e d i n that a collar (56)  
10 having two or more axial bores (58), is provided with  
bores (58) of similar or dissimilar diameters.

24. The well injection string (4) according to claim 21, 22  
or 23, c h a r a c t e r i z e d i n that at least one  
bore (58) is provided with a sealing plug.

15 25. The well injection string (4) according to any of claims  
21-24, c h a r a c t e r i z e d i n that the collar  
(56) is removably, pivotally or adjustably disposed  
around the injection string (4).

20 26. The well injection string (4) according to any of claims  
21-25, c h a r a c t e r i z e d i n that said housing  
(54), or a cover provided thereto, is removably disposed  
around the injection string (4).

27. The well injection string (4) according to any of claims  
21-26, c h a r a c t e r i z e d i n that the down-  
25 stream side of the housing (54) is connected to a sand  
screen (44).

28. A method of controlling an injection fluid outflow rate from at least one fluid outflow zone of a well injection string (4) intersecting at least one reservoir (6), the at least one fluid outflow zone being provided with one or more through-going pipe wall openings (28) located opposite the reservoir (6) when placed therein, said method being initiated by injecting said fluid from surface via the injection string (4) and then through at least one pressure-loss-promoting flow control device provided to at least one of said pipe wall openings (28) in the injection string (4), after which the injection fluid flows onwards into the surrounding reservoir (6), c h a r - a c t e r i z e d i n that the method further comprises:

- using an annular collar (56) provided with at least one axially through-going bore (58) as a flow control device;
- disposing the collar (56) pressure-sealingly around the injection string (4) so as to project outwardly therefrom; and
- disposing the collar (56) pressure-sealingly against an external and removable housing (54) pressure-sealingly enclosing said at least one pipe wall opening (28) in the injection string (4), thereby providing a through-going flow channel (38) between the collar (56) and the at least one pipe wall opening (28).

29. The method according to claim 28, c h a r a c t e r - i z e d i n that the method further comprises:

- connecting two or more collars (56) in series when placing two or more flow control devices within one fluid outflow zone along the injection string (4).



30. The method according to claim 28 or 29, c h a r a c -  
t e r i z e d i n that the method further comprises:  
- providing a collar (56) having two or more axial bores  
(58), with bores (58) of similar or dissimilar diameters.

5 31. The method according to claim 28, 29 or 30, c h a r -  
a c t e r i z e d i n that the method further comprises:  
- providing at least one bore (58) with a sealing plug.

10 32. The method according to any of claims 28-31, c h a r -  
a c t e r i z e d i n that the method further comprises:  
- disposing the collar (56) removably, pivotally or ad-  
justably around the injection string (4).

15 33. The method according to any of claims 28-32, c h a r -  
a c t e r i z e d i n that the method further comprises:  
- removably disposing said housing (54), or a cover pro-  
vided thereto, around the injection string (4).

34. The method according to any of claims 28-33, c h a r -  
a c t e r i z e d i n that the method further comprises:  
- connecting the downstream side of the housing (54) to a  
sand screen (44).